CHARACTERIZING FUEL LOADING AND STRUCTURE USING ECOLOGICAL LANDSCAPES (ELTs) IN THE MISSOURI OZARKS

Keith Grabner, Ecologist
USGS Northern Prairie Wildlife Research Center
301 Gentry Hall, University of Missouri, Columbia, MO 65211
Phone: (573) 882-0211
E-mail: GrabnerK@missouri.edu

George Hartman, Fire Ecologist
Missouri Department of Conservation
1110 College Ave., Columbia, MO 65211
Phone: (573) 882-9880
E-mail: hartmg@mail.conservation.state.mo.us

John Dwyer, Associate Professor
Bruce Cutter, Professor
School of Natural Resources, Dept. of Forestry
203 Anheuser-Bush Natural Resources Building
University of Missouri, Columbia, MO 65211
Phone: (573) 882-3537; (573) 882-2744
E-mail: DwyerJ@missouri.edu; CutterB@missouri.edu

ABSTRACT

Fuel loading and structure were estimated on 26 sites randomly located within Ecological Landtypes (ELT) within a 5657-acre preserve. ELT's are site scale units that are similar with respect to local landform position, geology, soils, and vegetation composition and structure. They range from 10 to 100's of acres in size.

Fuel loading within the 1 Hr., 10 Hr, 100 Hr, and 1000 Hr timelag classes were compared within and between ELTs. Additionally, herbaceous and leaf litter fuel loads were estimated and compared within and between ELTs.

Initial results indicate that there are differences in fuel loading and structure between ELTs. Quantifying the differences in fuel load can influence prescribed fire and wildfire management by identifying areas of heavy fuel loads that can produce intense fire behavior. Also, ELTs may function as planing units for prescribed fire planing.

Keywords: hardwood fuels, Ozarks, ecological classification, fuel loading

INTRODUCTION

This project was an attempt to describe and compare fuel loading and structure by ecological landtype (ELT) within southeastern Missouri. ELTs are site scale units (10 to 100s of acres in size) that represent areas with similar local landform, geology, soil attributes, and vegetation composition and structure. The ELTs being developed for southeastern Missouri are part of a larger Ecological Classification System (ECS) being developed by the Missouri Ecological Classification System Project (Meinert, D. et al. 1997).

ECS Applications

An ECS provides a framework to identify, describe, and map, using GIS technology, ecological units of land with similar biological (vegetation) and physical (climate, landform, geology, soil) characteristics at scales suitable for natural resources planning and management. An ECS is a tool for assessing the capability of land to sustain natural resources and respond to management. Additionally, an ECS is a common communication tool for considering the conservation of multiple natural resource values.

A hypothesis of ECS is that different ELTs will respond to disturbance differently and vegetation within a given ELT will respond to disturbance similarly.

Describing fuel conditions within ELTs will provide information that can be used for fire management. ELTs associated with high fuels loads that may support intense prescribed fires or wildfires can be identified during prescribed fire planing or wildfire suppression. Fuel loading estimates by ELT can aid in prescribed fire planing by permitting estimates of prescribed fire intensities and prescribed fire effects, thus allowing the evaluation of a prescribed fire plan.

Missouri Ecological Classification System

The Missouri Ecological Classification System Project is applying the US Forest Service National Hierarchy of Ecological Units to landscape classification in Missouri (Meinert, D. et al 1997). The hierarchy has eight levels that range from large, continental scale ecoregions (Domain, Division, Province) through biogeographical subregions (Section, Subsection), to local landscapes and individual sites (Landtype Association, Ecological Landtype and Phases) (Bailey, R. G. 1980, Keys, Jr., J. et al. 1995).

Landtype Associations (LTAs)

A team comprised of representatives from the Missouri Department of Conservation (MDC), Mark Twain National Forest, USDA Natural Resources Conservation Service, and the University of Missouri-Department of Geography are working together to develop Landtype Associations (LTAs) for Missouri. LTAs are landscape scale units (10s to 100s of square miles in size) which recognize patterns in local landforms, geology, soils, and vegetation.

Ecological Landtypes (ELTs) and Phases (ELTPs)

Ecological Landtypes and Phases (ELTs and ELTPs) are being developed within the uplands and riparian areas of the Current River Hills Subsection by a team from the Missouri Department of Conservation, University of Missouri-Department of Conservation, University of Missouri-Department of Forest, and US Geological Survey. ELTs and ELTPs are site scale units (10 to 100s of acres in size) that recognize distinct land units based on local landform position, geology (stratigraphy, parent material), soil attributes (depth, texture, water-holding, nutrient status), and vegetation composition and structure.

PURPOSE

The two purposes for this project were to:

1. Describe fuel loading and characteristics within a large preserve using ELTs to stratify fuel sampling, and
2. Compare fuel loading and characteristics between ELTs.

STUDY SITE

All fuel samples were collected from the Chilton Creek preserve, a 5657-acre preserve managed by The Nature Conservancy. Chilton Creek Preserve is located in Carter County, in southeastern Missouri. Within the ECS hierarchical classification, Chilton Creek is located in the Ozark Highlands Section, Current River Hills Subsection, and Current River Hills (LTA) (Figure 1). Oak-Hickory forests are the dominant forest type, but glade openings (openings in the forest characterized by thin soils and prairie vegetation) and mixed hardwood bottomland forests occur within the preserve.

METHODS

Sample Size

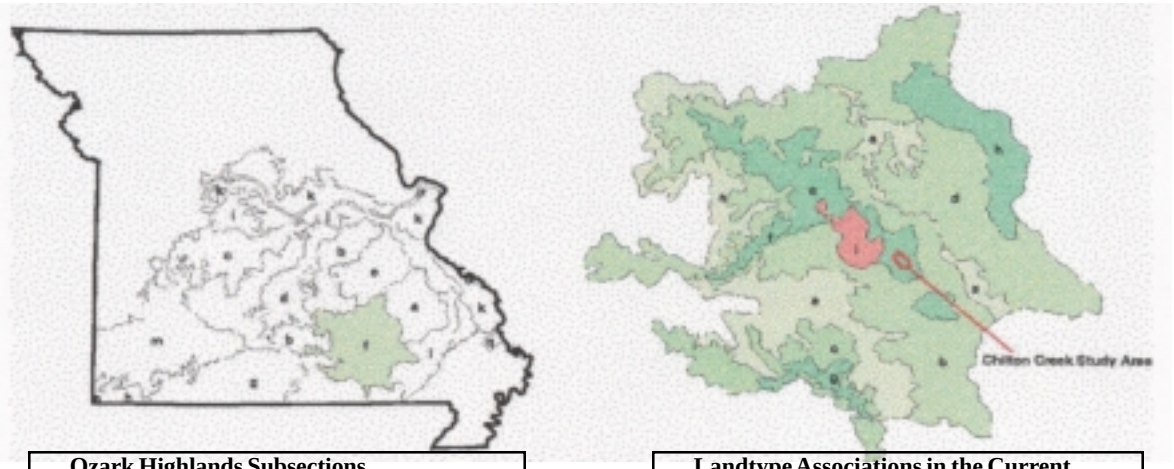
Data were collected from 24 plots located on eight different ELTs (Table 1, Figure 2).

Fuel Sampling

Methods followed Brown, J. (1974) and Brown, J. et al. (1982). Woody fuels were sampled by timelag class along 50 ft transects. Timelag classes are 1 hr (0-0.25 inches diameter), 10 hr (0.25-1 inch), 100 hr (1-3 inches), and 1000 hr (greater than 3 inches). Litter and herbaceous fuels were clipped from 2 sq. ft. plots located at the end of each transect. Fuel weights are on a dry weight basis. Litter depth was estimated every 5 ft. along the transect.

Data Analysis

Fuel differences were tested using Fisher's LSD multiple-comparison test (á=0.10).



Ozark Highlands Subsections

a. St. Francis Knobs and Basins
b. Central Plateau
c. Osage River Hills
d. Gasconade River Hills
e. Meramec River Hills
f. Current River Hills
g. White River Hills
h. Elk River Hills
i. Prairie Ozark Border
j. Inner Ozark Border
k. Outer Ozark Border
l. Black River Ozark Border
m. Springfield Plain
n. Springfield Plateau
o. Mississippi River Alluvial Plain
p. Mississippi River Alluvial
q. Illinois Ozarks

Landtype Associations in the Current River Hills Subsection

a. Current-Eleven Point Pine-Oak Woodland Dissected Plain
b. Current River Oak-Pine Woodland/ Forest Hills
c. Eleven Point River Oak-Pine Woodland/Forest Hills
d. Black River Oak-Pine Woodland/ Forest Hills
e. Current River Oak Forest Breaks
f. Jacks Fork River Oak-Pine Forest Breaks
g. Eleven Point Oak-Pine Forest Breaks
h. Black River Oak Forest Breaks
i. Eminence Igneous Glade/Oak Forest Knobs

Figure 1. Location of the Chilton Creek Preserve within the ECS hierarchial classification.

ELT	N	Aspect[1]	Landform	Parent Material[2]	Soil Classification	Mean Basil Area (ft^2 /Acre)	Mean Trees/Acre
3.1	3	Exposed	Backslope	RO/UG	Ultic	71.29	135
4.1	3	Exposed	Backslope	RO/UG	Ultic	90.94	150
5.2	1	Exposed	Backslope	LG/EM	Alfic	83.03	164
6.2	3	Protected	Backslope	LG/EM	Alfic	82.89	221
7.12	4	Exposed	Variable Depth	Chert & Dolomite		62.91	187
9.1	6	Ridge	Bench, Shoulder Ridge	LG/EM	Ultic	95.40	145
9.2	1	Ridge	Bench, Shoulder Ridge	LG/EM	Alfic	82.55	216
12	3	Waterway	Upland Waterway	LG/EM	Alluvial	55.46	147

Table 1. General Characteristics of sampled ELTs.

[1]Exposed Aspect = 120 to 330º. Protected Aspect = 330 to 120º.

[2]RO = Roubidoux sandstone; UG = Upper Gasconade dolomite; LG = Lower Gasconade dolomite; EM = Eminence dolomite

DISCUSSION

Fuel load and structure comparisons indicated that there were differences between ELTs (Table 2). The differences between ELTs were difficult to interpret due to the small unequal fuel sample size between ELTs. There were two reasons for the small and unequal sampling:

1. This was a pilot project to test the feasibility of using ELTs during fuel sampling, and the time we

were able to devote to field sampling was limited.
2. ELT designations were modified multiple times during this project. ELT designations are under development and as more data are collected and analyzed, ELT designations are being modified.

ELT designations are being finalized and field-tested this summer. A draft ELT manual will be completed by July 1999 and research crews working for MDC are field testing the ELT designations within the Missouri Ozarks. Once ELTs are finalized, they have the potential to be an excellent tool for stratifying the landscape into ecologically similar units that may respond in a similar manner to fire.

Collecting date by ELT provides date that can be easily modeled using GIS technology. Collecting data by ELT also provides a method for integrating different data sets.

We hope to increase fuel sampling stratified by ELT, in southeastern Missouri. The final goal is to summarize patterns in fuel loading by ELTs to provide a way to coarsely map fuel loading and characteristics over large areas. Additionally, this will provide a detailed fuel inventory within the Missouri Ozarks.

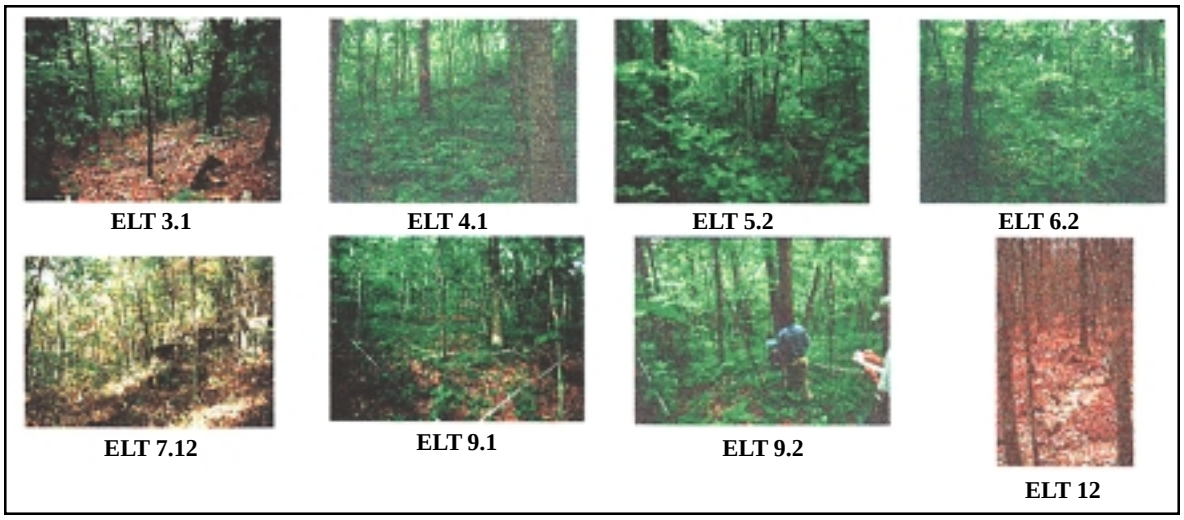


Figure 2. General appearance of the ELTs sampled.

		Mean Fuel Load (Tons/Acre)						
ELT	**N**	**1 Hr***	**10 Hr**	**100 Hr***	**1000 Hr***	**Clipped Fuels***	**Total Fuel Load***	**Litter Depth (in.)***
3.4	3	0.0235def	0.449a	0.719ab	3.766ab	1.946cde	6.904ab	2.9af
4.1	3	0.0232cdef	0.369a	1.057b	0.644a	1.659abcde	3.752a	1.5bcdef
5.2	1	0.0233bcdef	0.444a	1.061ab	3.608ab	1.919acde	7.056ab	1.4bcdef
6.2	3	0.0234def	0.447a	0.709ab	1.771a	1.609abcde	4.559ab	1.8bcdef
7.12	4	0.0233cdef	0.335a	1.327b	1.419a	1.449abc	4.554a	1.4bcdf
9.1	6	0.0269abc	0.397a	0.690ab	6.261b	1.770cde	9.173b	1.9def
9.2	1	0.0228abcde	0.436a	0ab	0ab	2.604	3.063ab	2.1acdef
12	3	0.0271abce	0.434a	0a	1.647a	1.448abce	3.552a	1.3bcd

Table 2. Comparison of fuel characteristics by ELT.
*Indicates fuel characteristics that were significantly different (á =0.10) between ELTs. Sample means within a column followed by the same letter are not significantly different (á = 0.10).

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LITERATURE CITED

Bailey, R. G. (1980). Descriptions of the ecoregions of the United States. Misc. Publ. 1391. Washington, DC: Department of Agriculture. 77p.

Brown, J. K. (1974). Handbook for inventorying downed woody material. USDA For. Serv. Gen. Tech. Rep. INT-16. 24p. Intermt. For. Exp. Stn., Ogden, Utah.

Brown, J. K., Oberheu, R. D., and Johnston, C. M. (1982). Handbook for inventorying surface fuels and biomass in the interior west. USDA For. Serv. Gen. Tech. Rep. INT-129. 48p. Intermt. For. Exp. Stn., Ogden Utah.

Keys, Jr., J, Capenter, C., Hooks, S., Koennig, F., McNab, W. H., Russell, W., and Smith M. L. (1995). Ecological units of the Eastern United States: First approximation. Atlanta, GA, U. S. Department of Agriculture, Forest Service. 83p. & foldout map.

Meinert, D., Nigh, T., and Kabrick, J. (1997). Landforms, geology, and soils of the MOFEP study area. *In Proc. Of the Missouri Ozark forest Ecosystem Project Symposium: an experimental approach to landscape research.* Eds. Brookshire, B. L. and Shifley, S. R. 1997 June 3-5; St. Louis, MO. Gen. Tech. Rep. NC-193. St. Paul, MN: USDA, For. Serv. North Central Forest Exp. Station. Pp56-68.